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cont as an arrayed waveguide grating type optical multiplexer/demultiplexer, effects such as improvement in flatness of light to be divided can be obtained.

IN THE CLAIMS

Please add Claims 18-45 as follows:

18. (New) An arrayed waveguide grating optical multiplexer/demultiplexer comprising:

at least one first optical waveguide;

a first slab waveguide;

an arrayed waveguide connected to said at least one first optical waveguide via said first slab waveguide, said arrayed waveguide comprising a plurality of channel waveguides each of which has a different length;

a second slab waveguide;

A18 a plurality of second optical waveguides connected to said arrayed waveguide via said second slab waveguide; and

at least one multi-mode waveguide having a first end portion and a second end portion, a second width of the second end portion being larger than a first width of the first end portion, the first end portion of each of said at least one multi-mode waveguide being connected to each of said at least one first optical waveguide, the second end portion of each of said at least one multi-mode waveguide being connected to said first slab waveguide, a width of said at least one multi-mode waveguide increasing from the first end portion toward the second end portion and being configured to realize multi-mode.

19. (New) An arrayed waveguide grating optical multiplexer/ demultiplexer according to Claim 18, further comprising:

at least one straight waveguide each provided between each of said at least one first optical waveguide and each of said at least one multi-mode waveguide, said at least one straight waveguide having a width narrower than the first optical waveguide width of said at least one first optical waveguide.

20. (New) An arrayed waveguide grating optical multiplexer/ demultiplexer according to Claim 18, further comprising:

at least one constant width waveguide provided between each of said at least one first optical waveguide and each of said at least one multi-mode waveguide, said at least one constant width waveguide having a substantially constant width which is substantially equal to the first width of the first end portion of said at least one multi-mode waveguide.

21. (New) An arrayed waveguide grating optical multiplexer/ demultiplexer according to Claim 20, further comprising:

a18 at least one straight waveguide provided between each of said at least one first optical waveguide and each of said at least one constant width waveguide, said at least one straight waveguide having a width narrower than the first optical waveguide width of said at least one first optical waveguide.

✓ 22. (New) An arrayed waveguide grating optical multiplexer/ demultiplexer according to Claim 18, wherein said at least one multi-mode waveguide has a trapezoidal shape in which the first end portion is an upper base and the second end portion is a lower base.

23. (New) An arrayed waveguide grating optical multiplexer/ demultiplexer according to Claim 18, wherein all of said at least one first optical waveguide are connected to all of said plurality of expanding width waveguides, respectively.

24. (New) An arrayed waveguide grating optical multiplexer/ demultiplexer according to Claim 18, wherein said at least one first optical waveguide comprises a plurality of first optical waveguides, said at least one multi-mode width waveguide comprises a plurality of multi-mode width waveguides, and wherein at least one of the plurality of first optical waveguides is connected to said first slab waveguide via at least one of the plurality of multi-mode width waveguides.

25. (New) An arrayed waveguide grating optical multiplexer/demultiplexer comprising:

at least one first optical waveguide;

a first slab waveguide;

an arrayed waveguide connected to said at least one first optical waveguide via said first slab waveguide, said arrayed waveguide comprising a plurality of channel waveguides each of which has a different length;

a second slab waveguide;

a plurality of second optical waveguides connected to said arrayed waveguide via said second slab waveguide; and

a plurality of multi-mode waveguides each having a third end portion and a fourth end portion, a fourth width of the fourth end portion being larger than a third width of the third end portion, the third end portion of each of said plurality of multi-mode waveguides being connected to each of said plurality of second optical waveguides, the fourth end portion of each of said plurality of multi-mode waveguides being connected to said second slab waveguide, a width of said multi-mode waveguides increasing from the third end portion toward the fourth end portion and being configured to realize multi-mode.

26. (New) An arrayed waveguide grating optical multiplexer/ demultiplexer according to Claim 25, further comprising:

a plurality of straight waveguides each provided between each of said plurality of second optical waveguides and each of said plurality of multi-mode waveguides, each of the said plurality of straight waveguides having a width narrower than the second optical waveguide width of each of said plurality of second optical waveguides.

27. (New) An arrayed waveguide grating optical multiplexer/ demultiplexer according to Claim 25, further comprising:

a plurality of constant width waveguides each provided between each of said plurality of second optical waveguides and each of said plurality of multi-mode waveguides, each of said plurality of constant width waveguides having a substantially constant width which is substantially equal to the third width of the third end portion.

Q 18 28. (New) An arrayed waveguide grating optical multiplexer/ demultiplexer according to Claim 27, further comprising:

a plurality of straight waveguides each provided between each of said plurality of second optical waveguides and each of said plurality of constant width waveguides, each of said plurality of straight waveguides having a width narrower than the second optical waveguide width of each of said plurality of second optical waveguides.

29. (New) An arrayed waveguide grating optical multiplexer/ demultiplexer according to Claim 25, wherein each of said plurality of multi-mode waveguides has a trapezoidal shape in which the third end portion is an upper base and the fourth end portion is a lower base.

30. (New) An arrayed waveguide grating optical multiplexer/demultiplexer comprising:

at least one first optical waveguide;

a first slab waveguide;

an arrayed waveguide connected to said at least one first optical waveguide via said first slab waveguide, said arrayed waveguide comprising a plurality of channel waveguides each of which has a different length;

a second slab waveguide;

a plurality of second optical waveguides connected to said arrayed waveguide via said second slab waveguide;

at least one first multi-mode waveguide having a first end portion and a second end portion, a second width of the second end portion being larger than a first width of the first end portion, the first end portion of each of said at least one first multi-mode waveguide being connected to each of said at least one first optical waveguide, the second end portion of each of said at least one first multi-mode waveguide being connected to said first slab waveguide, a width of said at least one first multi-mode waveguide increasing from the first end portion toward the second end portion and being configured to realize multi-mode; and

a plurality of second multi-mode waveguides each having a third end portion and a fourth end portion, a fourth width of the fourth end portion being larger than a third width of the third end portion, the third end portion of each of said plurality of second multi-mode waveguides being connected to each of said plurality of second optical waveguides, the fourth end portion of each of said plurality of second multi-mode waveguides being connected to said second slab waveguide, a width of said second multi-mode waveguides increasing from the third end portion toward the fourth end portion and being configured to realize multi-mode.

31. (New) An arrayed waveguide grating optical multiplexer/ demultiplexer according to Claim 30, further comprising:

at least one first straight waveguide each provided between each of said at least one first optical waveguide and each of said at least one first multi-mode waveguide, the at least one first straight waveguide having a width narrower than the first optical waveguide width of said at least one first optical waveguide.

32. (New) An arrayed waveguide grating optical multiplexer/ demultiplexer according to Claim 31, further comprising:

a plurality of second straight waveguides each provided between each of said plurality of second optical waveguides and each of said plurality of second multi-mode waveguides, the second straight waveguides each having a width narrower than the second optical waveguide width of each of said plurality of second optical waveguides.

Q18 33. (New) An arrayed waveguide grating optical multiplexer/ demultiplexer according to Claim 30, further comprising:

a plurality of second straight waveguides each provided between each of said plurality of second optical waveguides and each of said plurality of second multi-mode waveguides, the second straight waveguides each having a width narrower than the second optical waveguide width of each of said plurality of second optical waveguides.

34. (New) An arrayed waveguide grating optical multiplexer/ demultiplexer according to Claim 30, further comprising:

at least one first constant width waveguide each provided between each of said at least one first optical waveguide and each of said at least one first multi-mode waveguide, the first constant width waveguide having a substantially constant width which is substantially equal to the first width of the first end portion of said at least one first multi-mode waveguide.

35. (New) An arrayed waveguide grating optical multiplexer/ demultiplexer according to Claim 34, further comprising:

at least one first straight waveguide each provided between each of said at least one first optical waveguide and each of said first constant width waveguide, the first straight waveguide having a width narrower than the first optical waveguide width of said at least one first optical waveguide.

36. (New) An arrayed waveguide grating optical multiplexer/ demultiplexer according to Claim 34, further comprising:

a plurality of second constant width waveguides each provided between each of said plurality of second optical waveguides and each of said plurality of multi-mode waveguides, each of the second constant width waveguides having a substantially constant width which is substantially equal to the third width of the third end portion.

Q 18 37. (New) An arrayed waveguide grating optical multiplexer/ demultiplexer according to Claim 36, further comprising:

at least one first straight waveguide each provided between each of said at least one first optical waveguide and each of said at least one first constant width waveguide, the at least one first straight waveguide having a width narrower than the first optical waveguide width of said at least one first optical waveguide.

38. (New) An arrayed waveguide grating optical multiplexer/ demultiplexer according to Claim 37, further comprising:

a plurality of second straight waveguides each provided between each of said plurality of second optical waveguides and each of said plurality of second constant width waveguide, each of the second straight waveguides having a width narrower than the second optical waveguide width of each of said plurality of second optical waveguides.

39. (New) An arrayed waveguide grating optical multiplexer/ demultiplexer according to Claim 30, further comprising:

a plurality of second constant width waveguides each provided between each of said plurality of second optical waveguides and each of said plurality of second multi-mode waveguides, the second constant width waveguides each having a substantially constant width which is substantially equal to the third width of the third end portion.

40. (New) An arrayed waveguide grating optical multiplexer/ demultiplexer according to Claim 39, further comprising:

a plurality of second straight waveguides each provided between each of said plurality of second optical waveguides and each of said plurality of second constant width waveguides, the second straight waveguides each having a width narrower than the second optical waveguide width of each of said plurality of second optical waveguides.

Q18 41. (New) An arrayed waveguide grating optical multiplexer/ demultiplexer according to Claim 40, further comprising:

at least one first constant width waveguide each provided between said at least one first optical waveguide and said at least one first multi-mode waveguide, the at least one first constant width waveguide having a substantially constant width which is substantially equal to the first width of the first end portion of said at least one first multi-mode waveguide.

42. (New) An arrayed waveguide grating optical multiplexer/ demultiplexer according to Claim 30, wherein said at least one first multi-mode waveguide has a trapezoidal shape in which the first end portion is an upper base and the second end portion is a lower base, and wherein each of said plurality of second multi-mode waveguides has a trapezoidal shape in which the third end portion is an upper base and the fourth end portion is a lower base.

43. (New) A multi-mode waveguide comprising:

a first end portion; and

a second end portion having a second width larger than a first width of the first end portion, the first end portion being configured to be connected to a first optical waveguide, the second end portion being configured to be connected to a first slab waveguide, a width of said multi-mode waveguide increasing from the first end portion toward the second end portion and being configured to realize multi-mode.

44. (New) An optical waveguide circuit comprising:

a multi-mode waveguide comprising:

a first end portion; and

a second end portion having a second width larger than a first width of the first end portion, the first end portion being configured to be connected to a first optical waveguide, the second end portion being configured to be connected to a first slab waveguide, a width of said multi-mode waveguide increasing from the first end portion toward the second end portion and being configured to realize multi-mode.

45. (New) An optical waveguide circuit according to Claim 44, wherein said multi-mode waveguide has a trapezoidal shape in which the first end portion is an upper base and the second end portion is a lower base.

REMARKS

Favorable consideration of this application, as presently amended, is respectfully requested.